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Davis, CA.

Forest Site Characterization

PROGRAM WIND
COOPERATIVE ATMOSPHERIC RESEARCH

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FOREST SITE CHARACTERIZATION

A Program WIND Report

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PREFACE

Reported herein are findings of a field survey conducted to characterize the vegetation of a Program WIND study site. Program WIND (winds in non-uniform domains) is a joint study being conducted by the U.S. Department of Agriculture Forest Service and the U.S. Army to evaluate meteorological and particulate dispersion models. The models are of interest to both agencies for operational use in predicting winds and dispersal of particulates in the atmosphere. Field studies were conducted in northern California during the summer 1985, winter 1985, and spring 1986. Site characterization information will be used by scientists to evaluate and to report results of their Program WIND sub-studies conducted at a forest study site.

The authors wish to acknowledge the support provided by the Mendocino National Forest, specifically Jack Kennedy of the Chico Tree Improvement Center. We also appreciate the cooperation of the landowners, Diamond Lands Corporation and Bob Jones, for use of their lands for the Program WIND studies.

INTRODUCTION

Program WIND (winds in non-uniform domains) is a field study being conducted jointly by the United States Department of Agriculture Forest Service (FS), the U.S. Army Atmospheric Sciences Laboratory, and the U.S. Army Dugway Proving Ground. The purpose of the Program is to collect atmospheric information to evaluate meteorological and dispersion models. The base field study consisted of four phases, one for each season of the year. Meteorological data were collected for a 2-week period during each season. The study area (2,471 square miles, approximately 6,400 square kilometers) is in northern California, located north of Chico, east of Red Bluff, and southwest of Lassen National Park. Meteorological instrumentation was deployed throughout the area to measure atmospheric conditions from the surface to 25,000 feet above MSL. Approximately one half billion data points were collected during each field phase.

The purpose of this forest site characterization was to characterize a timber stand and to identify primary ground vegetation in the study area. The effect of the vegetation, primarily the timber stand on spray characteristics under various meteorological conditions, will be discussed in subsequent reports.

Several Program WIND sub-studies were conducted concurrently in addition to the base meteorological study. These sub-studies were designed to collect data to evaluate spray dispersion models. The dispersion models of interest in these sub-studies predict the fate, canopy penetration, and drift of aerially released sprays.

AREA DESCRIPTION OF SITE CHARACTERIZATION

The study area (Figure 1) is located on the western slope of the Sierra Nevada Range south of Minerals, CA between Red Bluff, CA and Lassen Volcanic National Park at a mean elevation of 3,240 feet above sea level. Specifically the study area is 1 mile southwest of the small community of Lyman Springs, Tehama County, CA, located in T. 28 N., R. 1 E. The forested site, owned by Diamond Lands Corporation, is in the SE and NE quarter of Section 7, and NE quarter of Section 18. The open area site, owned by Bob Jones, is in Ekblad Gulch and is planted in trees for the Christmas tree trade. It is located in the SW quarter of Section 7 and in the NW quarter of Section 18.

The area includes three general vegetation types in the uppermost reaches of an intermittent tributary of the North Fork of Antelope Creek: a second growth ponderosa pine stand, a Christmas tree plantation, and a brush-covered gully. The ponderosa pine stand is bordered on its western edge by the plantation, which is bisected by a gentle to moderately sloped gully, partially covered by relatively dense brush. Program WIND measurements were made in each of these three vegetation types.

The gentle sloping, well-drained soils "are formed in material weathered from volcanic rocks including andesite and breccia,"[1]. belonging to the Cohasset loam series.

FIELD METHODS

The second-growth ponderosa pine stand within the forest site was inventoried by standard forestry cruising techniques using a Spiegal Relaskop with a basal area factor (BAF) of 20[2]. (Figure 2). The cruise area was first delineated on recently acquired (1985) color aerial photographs (scale $\cong$ 1:25,150) and then measured. The rectangular area measured 4,200' x 3,150' (1,280 m x 960 m) and encompassed 304 acres (123 ha). Fifteen sample plots were established along three parallel cruise lines (3 x 5') in the

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1. Tehama County Calif. Soil Survey. May 1977. USDA.

2. The Spiegal Relaskop is an optical instrument which measures a variable radius plot rather than a fixed radius plot. It is sighted directly at the tree's trunk, 4.5' above ground level. In forestry this is referred to as diameter at breast height (dbh). An "in" or countable tree depends on the tree's diameter and its distance from the Relaskop; hence this method is unsuited for surface area measurement.

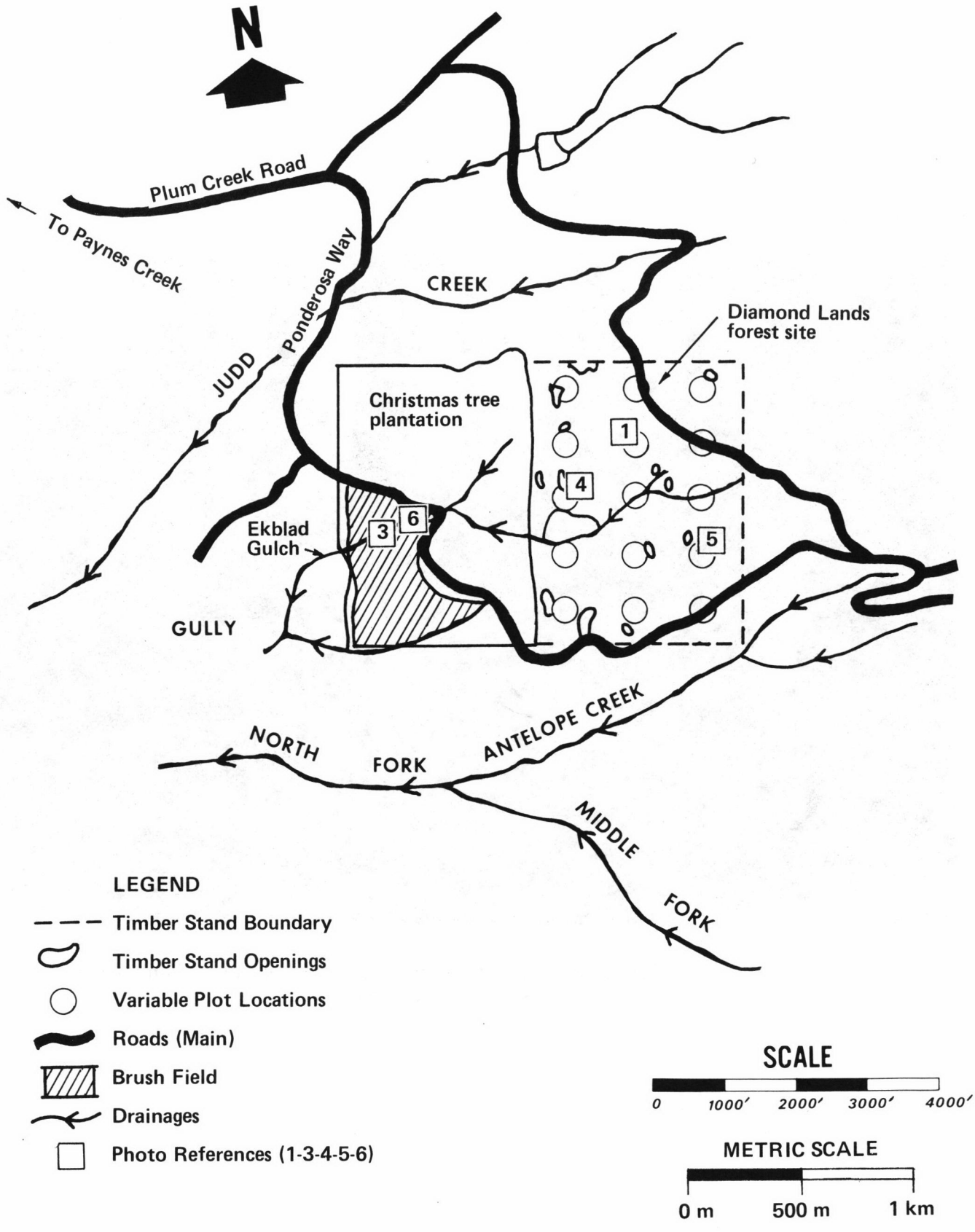

Figure 1 - Site map of the forest site characterization.

Figure 2 - Using the Spiegal Relaskop to determine "in" trees. Ponderosa pine overstory; note absence of ground cover.

stand. Distances between plots and cruise lines were measured by pacing on the ground. A 4.5' long Jake staff was placed at plot center from which all Relaskop sightings were made. In the event a questionable "in" tree was obscured or hidden by another tree or ground cover, the Relaskop point was offset the approximate distance. In addition to "in" trees the following data was also recorded at each point:

1. Tree species and their respective dbh (>4"). Diameters were measured with a diameter tape.

2. The total height of the first three "in" trees, regardless of species, with a Sunto clinometer.

3. Ground cover in a 1/10 acre circular plot if the cover occupied more than 5 percent of the plot. Estimates were made of the species, its height range and proportion of the plot covered. Trees smaller than 4-inches dbh were considered as ground cover.

4. Overstory density was measured with a Spherical Densiometer, Model C [3]. (Figure 3). The densiometer was placed on a swivel platform mounted on the Jake staff, oriented north and leveled by a small fish-eye level. There are 24 squares etched in the surface of the concave mirror. Each square was further divided (optically) into quarters and estimates made of the number of quarters occupied by the reflecting overstory. Readings were made from each cardinal direction and then averaged for each plot, as follows:

$$\Sigma \frac{\text{quarter squares occupied by overstory}}{4} \times 0.96 = \text{percent overstory density}$$

for example:

$$\frac{42(N) + 65(E) + 71(S) + 71(W)}{4} \times 0.96 = 60 \text{ percent overstory density}$$

This means that 60 percent of the horizontal surface as measured from its center, 4 1/2 feet above ground level, was covered by overstory.

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3. Manufactured by Paul E. Lemmon, 2413 Kenmore St., Arlington, Virginia.

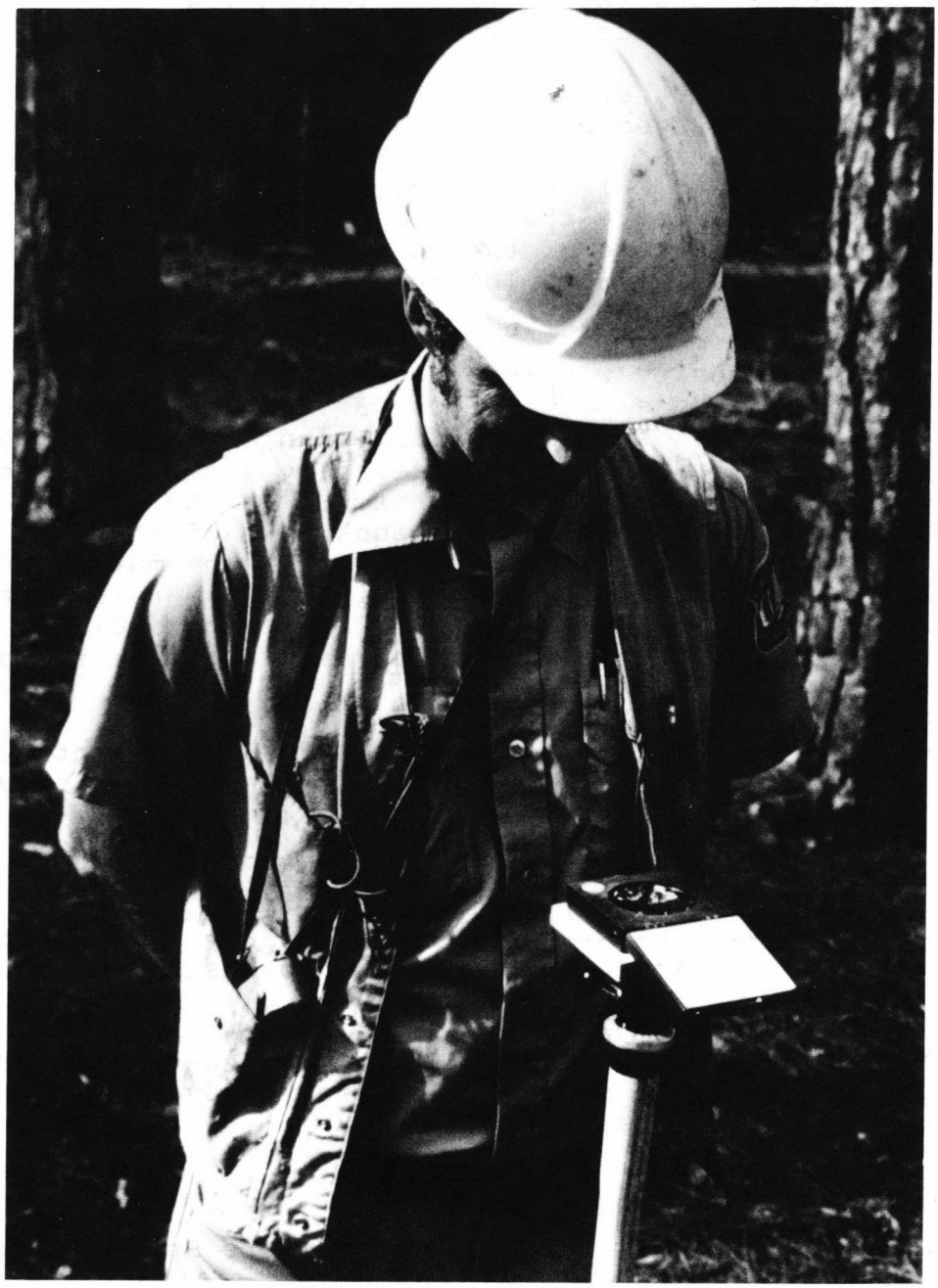

Figure 3 - Using the sperical densiometer to measure overstory density.

5. Incidental observations were made of other vegetation in the area that did not occur in the sample plots.

6. Increment borings were taken from a few dominant ponderosa pines to estimate stand age.

Table 1 summarizes the various vegetation types identified in the project area. No effort was made to quantify plant species in the Christmas tree plantation or gully.

RESULTS

Structure of the timber stand as measured during the variable plot cruise is shown in Table 2. It is essentially a two-storied stand with ponderosa pine dominating the overstory and incense cedar and oak comprising the understory (Figures 4 and 5). The ground cover, as listed in Table 3, consists primarily of manzanita with lesser amounts of ceanothus, incense cedar, and oak saplings.

The timber stand is anything but homogenous or contiguous. In those areas exhibiting a relatively dense ponderosa pine canopy, the understory is practically non-existent (Figure 2). In other areas where the crown canopy is more open, shade intolerent tree and brush species comprise the understory. There are also several natural and manmade openings, including roads, found throughout the stand.

Sugar pine, digger pine, and Populus sp. also were observed in the area but did not occur in the sample plots. It is estimated that these three species combined do not comprise more than five percent of the stand.

Although incense cedar was the dominant tree in terms of number of trees per acre (65/acre) their small size and short height amounted to only a fraction of the total biomass - 15 percent of the total basal area as compared to 76 percent for ponderosa pine. The average height of ponderosa pine was 80.4 feet with a range of 38-125 feet. The average height of incense cedar was 16 feet with the tallest reaching 73 feet. The incense cedar recorded as ground cover (<4 inches dbh) was only 11.6 feet (Table 3). The dominant ground cover, manzanita, averaged 6.7 feet in height followed by Ceanothus spp. which averaged 6.2 feet.

Increment borings showed the even-aged ponderosa pine stand to be approximately 75-80 years in age. The presence and condition of stumps indicated selective logging activity within the last 10 to 15 years.

The densiometer measurements provide an estimate of canopy density or crown closure. These readings are applicable to all vegetation over 4 1/2 feet high which includes much of the understory as well as some ground cover. The readings indicate the percent of vertical overstory as measured from a single point. Measurements

Table 1. Vegetation types identified in the project area, Project WIND, Paynes Creek, 1986

Common name	Scientific name	Occurrence in Timber stand	Occurrence in Gully
Ponderosa pine	Pinus ponderosa	X	
Digger pine	Pinus sabiniana	X	X
Sugar pine	Pinus lambertiana	X	
Incense cedar	Libocedrus decurrens	X	
Douglas-fir	Pseudotsuga menziesii	X	
Black oak	Quercus kelloggii	X	X
Oregon oak	Quercus garryana		X
Live oak	Quercus sp.	X	
Poplar	Populus sp.	X	
Willow	Salix sp.		X
Sierra plum	Prunus subcordata		X
Elderberry	Sambucus sp.		X
Mtn. mahogany	Cercocarpus	X	
Red Bud	Cercis occidentalis	X	
Buck brush	Ceanothus sp.	X	X
Deer Brush	Ceanothus sp.		X
White leafed manzanita	Arctostaphylos viscida	X	X
Greenleaf manzanita	Arctostaphylos patula	X	X
Gooseberry	Ribes sp.		X
Poison oak	Toxicodendron californicum	X	X
Squaw brush	Rhus trilobata		X
Calif. mugwort	Artemisia douglasiana		X
Himalaya berry	Rubus procerus		X
Largepetaled raspberry	Rubus macropetalus		X
Oregon grape	Mahonia sp.	X	X
Soap plant	Chlorogalum pomeridianum		X
Purple sanicle	Sanicola bipinnatifida		X
Fairy lantern	Calochortus amabilis		X
Cinquefoil	Potentilla glandulosa		X
Squaw Carpet	Rhus trilobata	X	
Bedstraw	Galium sp.		X
Needlegrass	Stipa sp.		X
Night shade	Solanum sp.		X
Calif. gromwell	Lithospermum californicum		X
Yellowstar thistle	Centaurea solstitialis		X
Common mullein	Verbascum thapsus		X
Tauschia	Tauschia hartwegii		X

Table 2 - Stand structure of ponderosa pine stand (forest study site), Program WIND, Paynes Creek area, Diamond Lands Corp., 1986.

	Trees	Acre	Basal Area/Acre		dbh (inches)		Height (feet)	
Tree Species[1.]	Qty.	%	Ft^2	%	Mean	Range	Mean	Range
Ponderosa pine	50	38.5	80	76.0	17.1	9-33	80.4	38-125
Incense cedar	65	50.0	16	15.2	6.4	4-17	15.9	13-73
Douglas-fir	1	0.7	1.3	1.2	14.0	-	75.0	-
Oak species	14	10.8	8	7.6	10.2	7-25	27.3	22-30
Total	130	100.0	105.3	100.0	11.0		42.5	

1. Greater than 4.0" diameter at breast height (dbh).

Figure 4 - Ponderosa pine overstory, incense cedar understory, and manzanita ground cover.

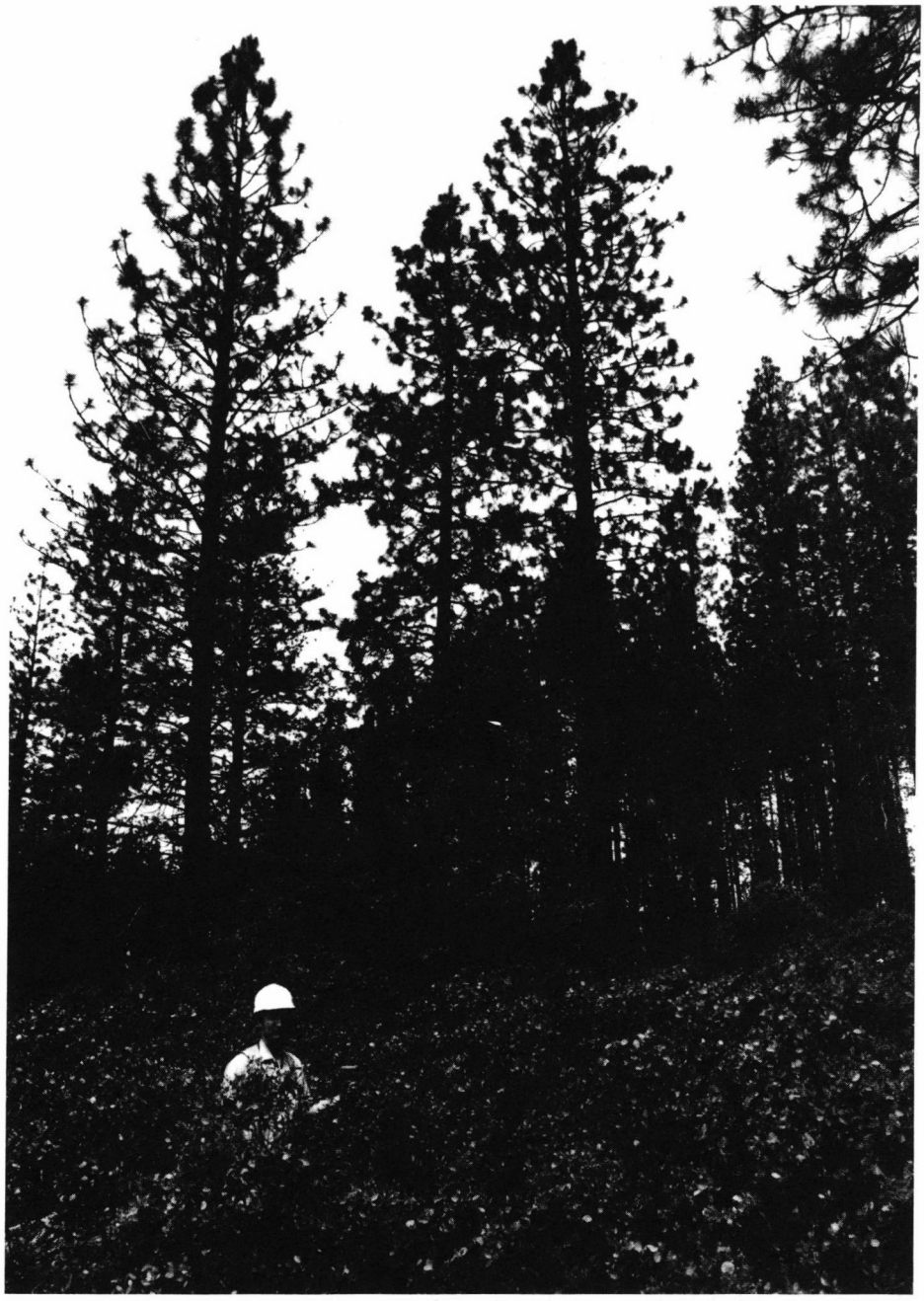

Figure 5 - Ponderosa pine overstory with heavy manzanita ground cover.

were made from 15 points. The average overstory closure for all fifteen points was 39 percent; in other words, 61 percent of overhead space was not occupied by canopy. Crown closure ranged from 4 to 60 percent.

Table 3 summarizes the ground cover vegetation, its relative occurrence and average height as recorded in the 15 - 1/10 acre plots. Tree species were recorded as ground cover if their dbh was less than 4 inches. Although manzanita was the principal ground cover followed by Ceanothus spp., it covered considerably less area.

The principal cover in Ekblad Gulch, the gully west of the stand, was manzanita and Ceanothus spp. (Figures 6 and 7).

In a typical forest environment, the overstory is the principal interceptor of spray droplets. The denser the tree canopy, the more particulates will be intercepted; that is, if the spray target is at ground level. A less dense canopy will permit more droplets to reach the ground.[4]

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4. Barry, John W. 1984. Deposition of chemical and biological agents in conifers. In: Chemical and Biological Controls in Forestry, Willa Y. Garner and John Harvey, Jr., editors: ACS Symposium Series 238.

Table 3 - Summary of woody ground cover species in ponderosa pine stand (forest study site), Program WIND, Paynes Creek area, Diamond Lands Corp., 1986.

Tree Species[1.]	Occurrence in plots (quantity)	Mean cover on 1/10 acre plot (percent)	Mean height (feet)
Manzanita	9	37	6.7
Incense cedar[2.]	4	6	11.6
Ceanothus	3	28	6.2
Quercus spp.	3	7	12.3
Ponderosa pine[2.]	1	20	22.5
Digger pine[2.]	1	5	25.0

1. No ground cover was recorded in 3 plots.

2. Less than 4 inches dbh.

Figure 6 - Ekblad Gulch, gully west of forest site, showing mixed brush ground cover (looking east).

Figure 7 - Ekblad Gulch, gully west of the forest site, showing mixed background cover (looking west).

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